



Callaway Plant

February 18, 2021

ULNRC-06638

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 50.73

Ladies and Gentlemen:

**DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC COMPANY
RENEWED FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2020-08-00
REACTOR TRIP DUE TO MAIN GENERATOR ELECTRICAL FAULT**

The enclosed license event report is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) to report a reactor protection system and auxiliary feedwater actuation.

This letter does not contain any new commitments.

Sincerely,

A handwritten signature in black ink, appearing to read "F. Bianco", with a large, sweeping flourish extending to the right.

Frederick Bianco
Senior Director, Nuclear Operations

Enclosure:
LER 2020-008-00

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cc: Mr. Scott A. Morris
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
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Arlington, TX 76011-4511

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Callaway Resident Office
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U. S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

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Index and send hardcopy to QA File A160.0761

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Missouri Public Service Commission

NRC FORM 366 (08-2020)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB: NO. 3150-0104		EXPIRES: 08/31/2023			
 LICENSEE EVENT REPORT (LER) (See Page 3 for required number of digits/characters for each block) (See NUREG-1022, R.3 for instruction and guidance for completing this form) https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/r1022/r3/										
1. Facility Name Callaway Plant, Unit No. 1					2. Docket Number 05000483		3. Page 1 OF 4			
4. Title Reactor Trip due to Main Generator Ground Fault										
5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
12	24	2020	2020	- 008 -	00	02	17	2021	Facility Name	Docket Number
										05000
										05000
9. Operating Mode MODE 1						10. Power Level 90%				
11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)										
<input checked="" type="checkbox"/> 10 CFR Part 20		<input type="checkbox"/> 20.2203(a)(2)(vi)		<input type="checkbox"/> 50.36(c)(2)		<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)		
<input type="checkbox"/> 20.2201(b)		<input type="checkbox"/> 20.2203(a)(3)(i)		<input type="checkbox"/> 50.48(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input checked="" type="checkbox"/> 10 CFR Part 73		
<input type="checkbox"/> 20.2201(d)		<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.69(g)		<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(4)		
<input type="checkbox"/> 20.2203(a)(1)		<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.71(a)(5)		
<input type="checkbox"/> 20.2203(a)(2)(i)		<input checked="" type="checkbox"/> 10 CFR Part 21		<input type="checkbox"/> 50.73(a)(2)(i)(B)		<input type="checkbox"/> 50.73(a)(2)(v)(D)		<input type="checkbox"/> 73.77(a)(1)(i)		
<input type="checkbox"/> 20.2203(a)(2)(ii)		<input type="checkbox"/> 21.2(c)		<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> 50.73(a)(2)(vi)		<input type="checkbox"/> 73.77(a)(2)(i)		
<input type="checkbox"/> 20.2203(a)(2)(iii)		<input checked="" type="checkbox"/> 10 CFR Part 50		<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)		<input type="checkbox"/> 73.77(a)(2)(ii)		
<input type="checkbox"/> 20.2203(a)(2)(iv)		<input type="checkbox"/> 50.36(c)(1)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)				
<input type="checkbox"/> 20.2203(a)(2)(v)		<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)				
<input type="checkbox"/> Other (Specify here, in Abstract, or in NRC 366A).										
12. Licensee Contact for this LER										
Licensee Contact T. B. Elwood, Supervising Engineer, Regulatory Affairs and Licensing									Phone Number (Include Area Code) 314-225-1905	
13. Complete One Line for each Component Failure Described in this Report										
Cause	System	Component	Manufacturer	Reportable To IRIS	Cause	System	Component	Manufacturer	Reportable To IRIS	
B	TB	GEN	G080	Y						
14. Supplemental Report Expected					15. Expected Submission Date			Month	Day	Year
<input checked="" type="checkbox"/> No					<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date)					
16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)										
On December 24, 2020 at 1235 with the reactor at approximately 90% rated thermal power, a main generator fault occurred that led to a turbine trip and reactor trip. Safety systems functioned as required, including actuation of the auxiliary feedwater system and a main feedwater isolation due to a valid feedwater isolation signal. Operations staff responded to the event in accordance with applicable plant procedures. The post-trip investigation indicated that a fault internal to the main generator actuated the main generator protection system, which in turn caused the turbine trip and an automatic reactor trip since reactor power was above the P-9 setpoint.										
This reactor trip was reported by Event Notification 55049 in accordance with 10 CFR 50.72(b)(2)(iv)(B) and 50.72(b)(3)(iv)(A).										
The cause of the generator fault was due to failure of the connection rings on the main generator stator. Both the collector end connection ring (i.e., phase ring) and the turbine end connection ring (i.e., serial ring) failed, resulting in an electrical path from the generator stator to ground. This electrical path resulted in a generator protection fault that was detected by the generator neutral ground overcurrent relay resulting in a generator trip and turbine trip.										
Corrective actions involve restoration of the main generator to its original design, including replacement of the connection rings. Generator support systems are being refurbished as necessary.										

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form
<https://www.nrc.gov/reading-m/doc-collections/nuregs/staff/sr1022/r3/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk at: oina_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Callaway Plant, Unit No. 1	05000-483	2020	- 008	- 00

NARRATIVE**1. DESCRIPTION OF STRUCTURE(S), SYSTEM(S), AND COMPONENT(S):**

The systems and components affected by this event include the reactor protection system and the main generator.

The reactor protection system at Callaway Plant initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and reactor coolant system pressure boundary design limits during anticipated operational occurrences and to assist the Engineered Safety Features systems in mitigating accidents.

The main generator is a non-safety related component that converts the rotational kinetic energy generated by the turbine into electrical energy. The turbine receives high pressure steam from the main steam system and converts a portion of its thermal energy into rotational kinetic energy. The main generator has a number of trips in order to protect this asset from irreparable damage. Internal to the main generator are connection rings that connect groups of windings in the stator in a sequential pattern to create a sinusoidal electrical wave form when subjected to an electrical field produced by the rotor. The main generator was originally manufactured by General Electric as model number 180X732. EISS System Code: TB; Function Code: GEN

2. INITIAL PLANT CONDITIONS:

Callaway was in MODE 1 at approximately 90% rated thermal power at the time of this event. Power ascension was in progress following a return to service from a refueling outage that had ended on December 22, 2020. No major safety related systems were out of service.

3. EVENT DESCRIPTION:

On December 24, 2020 at 1235 with the reactor at approximately 90% rated thermal power, the reactor automatically tripped as a result of a turbine trip caused by a main generator fault. Safety systems functioned as expected. The Operations staff responded to the event in accordance with applicable plant procedures. An ENS notification (ENS 55049) was made for this event at 1514 hours on December 24, 2020.

Prior to the event, operators had been raising power while returning the unit to service following a refueling outage. The generator had been placed in service on December 22, 2020. Preceding the reactor trip, annunciators associated with the generator monitoring instrumentation and generator auxiliary systems were received. Following receipt of the annunciators, the reactor power ascension was stopped and non-licensed operators were dispatched to investigate local annunciators and the operation of generator auxiliary systems. In addition to the annunciators, indication of abnormal stator cooling water system conductivity and decreasing main generator hydrogen pressure were observed. During the investigation of the cause of the annunciator, the automatic reactor trip occurred as a result of the actuation of generator protective relaying.

The cause of the generator fault was due to failure of the connection rings on the main generator stator. Both the collector end connection ring (i.e., phase ring) and the turbine end connection ring (i.e., serial ring) failed, resulting in an electrical path from the generator stator to ground. This electrical path resulted in a generator protection fault that was detected by the generator neutral ground overcurrent relay resulting in a generator trip and turbine trip. The underlying cause of the connection ring failure is still under investigation and will be determined during the course of the generator disassembly and repair.

Per plant design, an auxiliary feedwater system actuation occurred as expected in response to the reactor trip. Also, consistent with plant response to a reactor trip from a high power level, a main feedwater isolation signal was generated.

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Callaway Plant, Unit No. 1	05000-483	2020	- 008	- 00

Following the reactor trip, an erratic position indication was observed for one feedwater isolation valve, but the valve was subsequently confirmed to be closed. In addition, one intermediate range nuclear instrumentation channel failed. Other nuclear instrumentation channels functioned correctly to indicate the shutdown state of the reactor. These failures did not complicate the operators response to the event.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

There were no actual nuclear, radiological, or personnel safety impacts associated with this event. The potential impact was on nuclear safety with respect to challenging the reactor trip system as well as any potential challenges to the plant due to the transient associated with a reactor trip. However, all safety systems functioned as designed, and the reactor automatically tripped (i.e., shut down) per design when the main generator ground fault was detected.

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 50.73(a)(2)(iv)(A) to report a reactor protection system actuation during startup and an auxiliary feedwater actuation. Specifically, 10 CFR 50.73(a)(2)(iv)(A) states in part, "The licensee shall report:

(A) Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section...

(B) The systems to which the requirements of paragraph (a)(2)(iv)(A) of this section are:

- (1) Reactor protection system (RPS) including: reactor scram or reactor trip....
- (6) PWR auxiliary or emergency feedwater system

The RPS was actuated on December 24, 2020 at 1235. This fulfills the reporting requirement of 10 CFR 50.73(a)(2)(iv)(A) by actuation of the system specified in 10 CFR 50.73(a)(2)(iv)(B)(1).

A valid auxiliary feedwater system actuation was initiated after the reactor trip. This fulfills the reporting requirement of 10 CFR 50.73(a)(2)(iv)(A) by actuation of the system specified in 10 CFR 50.73(a)(2)(iv)(B)(6).

6. CAUSE OF THE EVENT:

The cause of the generator fault was due to failure of the connection rings on the main generator stator. Both the collector end connection ring (i.e., phase ring) and the turbine end connection ring (i.e., serial ring) failed resulting in an electrical path from the generator stator to ground. This electrical path resulted in a generator protection fault that was detected by the generator neutral ground overcurrent relay resulting in a generator trip and turbine trip. The underlying failure mechanism affecting the connection rings will be determined and addressed during the course of the generator disassembly and repair.

7. CORRECTIVE ACTIONS:

Corrective actions involve restoration of the main generator to its original design, including replacement of the connection rings. Generator support systems are being refurbished as necessary.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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Callaway Plant, Unit No. 1	05000-483	YEAR 2020	SEQUENTIAL NUMBER - 008	REV NO. - 00

8. PREVIOUS SIMILAR EVENTS:

No previous occurrences of a main generator trip due to an electrical fault internal to the generator have occurred at Callaway Plant. Three occurrences of a reactor trip of a similar nature due to main generator protective relaying actuation are identified and summarized below.

On July 26, 2013, a turbine trip occurred when electrical faults caused damage to the isophase bus in the auxiliary transformer and main generator neutral connection box. The turbine trip resulted in a reactor trip. See LER 2013-008. (Ameren Missouri letter ULNRC-06042, ML13268A112).

On December 3, 2014, a turbine trip occurred when the main generator excitation transformer faulted to ground. The turbine trip resulted in a reactor trip. See LER 2014-006. (Ameren Missouri letter ULNRC-06178, ML15033A215).

On September 27, 2020, a turbine trip occurred due to a main generator fault that was the result of a piece of a laminated-style flexible link located in an isophase bus duct becoming detached and causing a phase-to-ground fault. The turbine trip resulted in a reactor trip. See LER 2020-006. (Ameren Missouri letter ULNRC-06620, ML20330A266).